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Matching across space: evidence from Finland

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Matching across space: evidence from Finland

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Abstract

This paper studies spatial aspects in local labour markets in Finland from the perspective of a matching approach. The monthly data comprise 173 Local Labour Office areas over a 12-year period between January 1991 and August 2002. The basic matching function is extended to account for spatial spill-overs between the local labour markets. The role of population density in the matching process is also examined. According to results, the Finnish local labour markets suffer from a strong congestion effect among job seekers, and spatial spill-overs even strengthen the congestion. An open vacancy is filled much easier than a job seeker is employed. The results show that the matching efficiency is remarkable lower in dense areas than elsewhere, which indicates that mismatch is a problem in the local labour markets with high population density. When taking population density into account, returns to scale in the matching function are constant.

Keywords: matching, spatial spill-over, population density, returns to scale, Finland

1. Introduction

This paper studies spatial aspects in local labour markets in Finland from the perspective of a matching approach. The complicated exchange process in labour markets in this context is summarised by a well-behaved function that gives the number of jobs formed at any moment in time in terms of the number of workers looking for jobs, the number of firms looking for workers, and a small set of other variables (Petrongolo and Pissarides 2001). In brief, a matching function expresses new employment relationships formed per unit time as a function of the stock of open vacancies and job seekers. The matching function in this study is extended to account for spatial spill-overs in the Finnish local labour markets i.e. new employment relationships are expressed as a function of the stock of open vacancies and job seekers both in the local and neighbouring labour markets.

A common approach on matching function has been to concentrate on returns to scale, especially whether the returns to scale are constant or increasing (e.g. Pissarides 1986, Blanchard and Diamond 1989, Warren 1996). If returns to scale are not constant, the mean transition rates for workers and firms engaged in search are dependent on the number of searchers. In a matching environment, the returns to search for each trader are related to what other traders do (Petrongolo and Pissarides 2001). The average time that it takes a firm to find workers depends crucially on what job searchers do before they meet the firm, and the probability that a job seeker finds a job depends on what hiring firms do. If the speed of the matching process changes with the amounts of job seekers and vacancies, returns to scale are not constant.

In the case of increasing returns to scale, there is a possibility for more than one equilibrium, both a high-activity and a low-activity equilibrium, because of positive externalities in the search process (Pissarides 2000). In a high activity equilibrium firms and workers put more effort into search and in another they put less effort into search also having lower returns from search. According to Blanchard and Diamond (1989), active thick markets may lead to easier match, with or without more intensive search. If returns to scale are decreasing, the matching function is characterised by diseconomies of scale. In that case, negative congestion effects in the labour markets are stronger than positive

externalities. Estimated matching functions can give a measure of the extent of the externalities.

An interesting point is that the estimates on returns to scale also tend to differ between aggregated and disaggregated data. There are two aggregation problems in the matching modelling: spatial and temporal aggregation. Coles and Smith (1996) argue that spatially disaggregated matching functions may exhibit increasing returns to scale. However, in studies using the data from local labour markets returns to scale are often turned out to be decreasing (Burda 1993; Burda and Wyplosz 1994; Burda and Profit 1996; Burgess and Profit 2001; Kangasharju et al. 2004b).

Temporal aggregation is another aggregation problem in the matching modelling. Since the matching function describes a process that takes place continually in spatially distinct locations, the use of discrete-time data always introduces temporal aggregation problems. Burdett et al. (1994) argue that the size of the bias in matching elasticity is approximately a linear function of the measuring interval. Thus, it is important to use as highly disaggregated data as possible.

The data in this study is both spatially and temporally highly disaggregated monthly panel data from 173 Local Labour Offices in Finland from 12 years. Finnish public employment agency is a remarkable actor in the process of connecting searching workers and employers ¹. The main focus is in spatial aspects of the matching process. The key ideas are to look at the spatial externalities in the search process of workers and employers between the areas of Local Labour Offices, asymmetry of these effects, and significance of population density and the size of the labour market in the matching process. It proves to be important to study these aspects of the matching process.

The results show that congestion effect among job seekers in local labour markets is remarkable and also spreads over neighbouring Local Labour Offices. Remarkable signs of asymmetry in spatial spill-overs are not found. According to the results, population density matters in the matching process. Efficiency of the matching process is much lower in the areas with high population density than elsewhere. Mismatch in the labour markets seems to be a problem in dense central areas, whereas low demand for labour causes high unemployment rate in distant areas. An open vacancy is filled much easier

than a job seeker is employed. When taking population density into account, returns to scale in the matching function are constant.

The remainder of this paper is organised as follows. Section 2 justifies the perspective of this study based on previous literature. Section 3 describes the data. Section 4 deals profoundly with the matching process in Finland, and Section 5 concludes.

2. Spatial aspects in the matching function

A common practise in the earlier matching function research is to use aggregate time series data for the whole economy or a particular sector, usually manufacturing. A spatially aggregated matching function is based on the assumption of the existence of disequilibrium in homogenous micro markets and limited mobility of labour (Petrongolo and Pissarides 2001). Spatial aggregation also assumes that submarkets itself do not suffer from any frictions but there are frictions only between submarkets. Markets with unemployment can therefore coexist with markets with open vacancies although no market has both, which make it possible that there exist an aggregate matching function. If job matching took place instantaneously, there would not be any matching function. Hansen (1970) was the first who used this kind of modelling. He derived the Beveridge curve based on these assumptions.

In many recent studies spatial aggregation is rejected, and the data are collected from the local labour markets (Burda and Profit 1996; Coles and Smith 1996; Burgess & Profit 2001; Kangasharju et al. 2004 a and b). This practise takes into account the possibility that the aggregate economy is actually a collection of spatially distinct and heterogeneous labour markets that can suffer from many frictions. Blanchard and Diamond (1989) emphasise that large labour market flows in relation to stocks generate delays in the finding of both jobs and workers even though the process was extremely efficient. This practise also makes it possible to examine more precisely spatial aspects in the matching function and magnitude of interactions between submarkets in the economy.

Thus, it has been shown to be empirically useful to consider the national labour market as a collection of spatially distinct labour markets that interact with each other. Job

seekers and firms are located somewhere, and their location is one of the key factors in the matching process. Burda and Profit (1996) extended the basic spatially and temporally disaggregated matching function $M_{i,t} = m_{i,t}(U_{i,t-1}, V_{i,t-1})$ to account for spill-overs $U_{i,t-1}^*$ and $V_{i,t-1}^*$ from neighbouring areas to a local outflow from unemployment. They found that “foreign” unemployment has significant effects on local matching and that the sign and strength of the effect depend on distance.

Burgess and Profit (2001) extended this approach to account for both an unemployment and a vacancy outflow as dependent variables, and by analysing cyclical variations of spatial dependence in matching. They found cyclical variations in the strength of the spatial spill-overs in the matching process: when agents are in a strong position in the business cycle, they can afford to only search locally. When their position weakens, agents widen their search radius search effort being more intense in neighbouring markets.

Burgess and Profit (2001) also found some signs of asymmetry of spatial spill-overs in the matching process, that is, the ratio of an area’s own unemployment to unemployment in neighbouring areas affect spill-overs’ magnitude. They found that unemployed workers widen their search radius and search more intensively in neighbouring areas if unemployment rate is much higher in their home area than in neighbouring areas. Firms may also tend to recruit workers more intensively from areas with very high unemployment.

Job searching is closely related to migration behaviour. People are more likely to move from areas with high unemployment. According to the search theory, the explanation for this phenomenon is that unemployed people search more actively. Jackman and Savouri (1992) concluded that migration could be viewed as a hiring or job search phenomenon. They found that high unemployment raises out-migration but reduces in-migration because of the crowding-out effect of the job search of locally unemployed persons. The long-run unemployment reduces out-migration and raises in-migration because of reduced search intensity. Jackman and Savouri (1992) also found that a high level of job vacancies in a region encourages in-migration.

One central point of this study is to examine the effects of population density on the matching process at the spatial level. According to Coles and Smith (1996) the search process would be faster and matching rates higher in areas with dense pool of workers and firms. According to them, the amounts of job seekers and vacancies do not matter but the population density of the “market place” matters. At a given level of job seekers and vacancies both parties would be close and easy to communicate each other with lower efforts and costs. In their study, wages however correlate positively with city size suggesting better matches in larger cities, since unemployed agents search more effectively when wages are high. According to them, the explanation could be that the benefit from searching in a thicker market might come in the form of higher-quality matches rather than a faster matching rate.

Petrongolo (2001) found in her micro-level study in Britain that thicker and more active markets do not necessarily lead to easier trading. As Coles and Smith (1996), she suggests that the matching process may display increasing returns as far as quality, as opposed to the number, of matches is concerned. According to this idea, thick markets provide better matching opportunities to highly specialised labour and therefore tend to enhance average productivity and wages.

Kano and Ohta (2003) represent an opposite view. They argue that the matching efficiency can be negatively correlated with population density. Their explanation for this finding is that skill requirements and endowments are distributed more widely in urbanised areas with high population density. On the other side of the market, firms’ hiring standards and payable wages are distributed over wide range. Thus, higher population density can make it harder to form a successful match.

3. The data

The 173 Local Labour Offices (LLO) in Finland are looked at in this study. The data are from the registers at the Ministry of Labour that records monthly outflows of vacancies and the end-of-month stocks of vacancies and job seekers². The time span of the data is from January 1991 to August 2002. Basic descriptive statistics of the data are represented in Table 1. Corresponding facts of the group of the high population density LLOs

are tabulated in the same table. This group consists of 18 LLOs with population density as high as or higher than an average value that is 57 persons per a square kilometre.

The Finnish labour markets are quite exceptional in the international context. There is little in number labour force living quite dispersed in a very large area. During 1990s there were however in the Finnish context large migration flows from rural areas to urban centres, and the labour force concentrated on few centres more extensively than during previous decades. Especially highly educated workers are willing to move into urban centres (e.g. Ritsilä and Haapanen 2003). The role of population density in the matching process is thus interesting to investigate.

Figure 1 shows how a job seeker/vacancy ratio and a vacancy outflow behave in the business cycle. During a recession finding a job is harder since many people are searching and few open vacancies are being posted. On the other side, filling an extra vacancy is more costly when the economy is booming and fewer workers are searching. Thus, a job seeker/vacancy ratio is countercyclical. That ratio increased dramatically during a recession in Finland at the beginning of the 1990s. During 1993 there were on average 115 job applicants per an open job vacancy, while during 2001 the number was 27. A vacancy outflow in turn varies cyclically, and was lowest during the deepest position of the recession. A turning point was reached during 1994. After it the job seeker/vacancy ratio decreased while the number of filled vacancies increased. The negative relationship between the job seeker/vacancy ratio and the vacancy outflow is evident.

Job seekers in this study consist of unemployed (either fully unemployment or temporarily laid off), employed job seekers who have registered at Local Labour Office, and job seekers out of labour force. Those who are working a shortened week or having disability pension are also included in all job seekers. Getting unemployment benefits requires active job searching: an unemployed person has to report regularly at the local labour centre. Employed job seekers are those who are working but are threatened by unemployment, hope to switch jobs, or are in subsidised job seeking other type of employment. It is well documented in previous studies that accounting for non-unemployed job seekers' role in the matching process is important (e.g. Blanchard and

Diamond 1994; Lindeboom et al. 1994; van Ours 1995; Broersma 1997; Broersma and van Ours 1999; Hämäläinen 2003 and Kangasharju et al. 2004b in Finland).

4. The matching process in Finland

The main focus of this study is to look at the spatial externalities between the areas of Local Labour Offices in the search process of workers and firms, possible asymmetry of these effects, and significance of population density and the size of the labour market in the matching process. Estimated matching functions can give a measure of the extent of the externalities in the matching process, which can appear both locally and between neighbouring areas. Congestion effect measures the negative externality caused by job seekers on other job seekers or by firms on other firms. Thick-market effect measures the positive externality from firms to searching workers or from job seekers to firms.

If the elasticity with respect to job seekers in the matching function is α and the elasticity with respect to vacancies β , $\alpha-1$ measures congestion caused by job seekers on other job seekers and β thick-market effect from firms to job seekers. α measures the positive externality from workers to firms, and $\beta-1$ measures the negative externality caused by firms on each other. Thus, higher elasticity estimates indicate less congestion and more positive externalities. (Petrongolo & Pissarides 2001).

The modelling starts with the basic log-linear Cobb-Douglas specification. In further models spatial spill-over variables, the stocks of vacancies and job seekers in neighbouring areas, are included in the model and also the possibility of asymmetry of these spill-overs is accounted for. Finally, dummy variables on high population density are included in the model and effects of population density on both matching efficiency and matching elasticities are explored.

4.1 Basic specification

The basic model is a Cobb-Douglas specification of the matching function in log-linear form with fixed effects for months and years and also for districts.

$$\ln M_{i,t} = \mu_i + \alpha \ln S_{i,t-1} + \beta \ln V_{i,t-1} + \eta_y + \gamma_s + u_{i,t}, \quad (1.)$$

where $M_{i,t}$ is the number of filled vacancies in LLO i during month t , $S_{i,t-1}$ and $V_{i,t-1}$ are stocks of registered job seekers and open vacancies in LLO i at the beginning of period t , μ_i is a LLO fixed effect controlling for regional characteristics, η_y is a time fixed effect controlling for aggregate shocks, γ_s a time fixed effect controlling for seasonal fluctuations in the matching process, and $u_{i,t}$ is the error term.

The results of the regressions are summarised in Table 2. In the OLS-estimation when the intercept term is restricted to be the same across LLOs, the constant-returns-to-scale assumption is rejected, and the results indicate diminishing returns to scale (Table 2: specification 1). As typically in the matching models where the dependent variable is a vacancy outflow, the coefficient of vacancies is higher than that of job seekers. The higher coefficient for vacancies is not, however, sufficient to cancel out negative congestion among job seekers, and the returns to scale are diminishing.

According to results on the fixed effects model with LLO fixed effects, the congestion effect among job seekers seems to be huge, a coefficient for job seekers do not significantly differ from zero (Table 2: specification 2). Thus, when allowing for different technology parameters for LLOs, the job seeker stock's effect on matches disappears. One explanation could be that job seekers alone do not increase matches but appropriate technology in the matching process is needed to support searching. Another explanation could be that there are so many time-invariant differences between the areas that the district-specific fixed effects dominate in the model.

4.2 Spatial spill-overs

Adding the stocks of job seekers and vacancies in neighbouring LLOs into the model yields

$$\ln M_{i,t} = \mu_i + \alpha \ln S_{i,t-1} + \alpha^* \ln S^*_{i,t-1} + \beta \ln V_{i,t-1} + \beta^* \ln V^*_{i,t-1} + \eta_y + \gamma_s + \mu_{i,t}, \quad (2.)$$

where $\alpha^* \ln S^*_{i,t-1}$ and $\beta^* \ln V^*_{i,t-1}$ measure external effects of job seekers and vacancies in neighbouring areas. The neighbourhood matrix is a simple binary contiguity matrix, and the neighbouring variables are weighted averages of the variable values at neighbouring locations (Anselin 1988).

The results are interesting. Opposite to Burgess and Profit (2001), an increase in job seekers in the neighbouring locations decreases matches in the local area, and an increase in open vacancies in the neighbouring offices increases local matches (Table 2: specifications 3 and 4). Adding the spill-over variables also have remarkable effects on the coefficient of local job seekers. It becomes clearly positive and significant also in the fixed effects model.

In the fixed effects model the coefficient for neighbouring job seekers is highly negative. The congestion caused by neighbouring job seekers seems to be strong. Thus, it seems that job seekers have a negative spill-over effect on the neighbouring labour market – they strengthen the congestion among job seekers in the area. Neighbouring vacancies have a positive externality on local job seekers but this externality is weak. As a consequence, the returns to scale are even lower in the models with spill-over variables than in the basic model.

4.2.1 Asymmetry of spatial spill-overs

It would be possible that that the spatial spill-overs were asymmetric, that is, the ratio of an area's own unemployment rate to unemployment rate in neighbouring areas would affect magnitude of spill-overs. This assumption is based on the many previous findings on that people are likely to widen their search radius when unemployment in their home area increases relative to other areas in the economy. According to Ritsilä and Tervo

(1999), regional unemployment in Finland is even more dominating factor in migratory decisions than personal unemployment. In the matching context, working in a neighbouring area does not require moving because it is possible to commute daily between home and a workplace.

Following the method of Burgess and Profit (2001), asymmetry of spatial spill-overs is analysed by constructing the ratio of a weighted average of unemployment rate in neighbouring LLOs (the numerator) to unemployment rate in the local LLO (on the denominator). A high value tells that the LLO is surrounded by LLOs with unemployment rate much higher than locally, and a low value tells that unemployment rate in neighbouring LLOs is much lower than locally. Two dummy variables are constructed based on this ratio: one that picks out the LLOs in the top of 10% of the distribution of this and one picking out the bottom 10%. The basic spill-over variables are multiplied by the new dummies, and these new variables are included in the regression alongside the basic spill-over variables. The model takes the following form:

$$\ln M_{i,t} = \mu_i + \alpha \ln S_{i,t-1} + \alpha^* \ln S^*_{i,t-1} + \alpha^{*HR} \ln S^{*HR}_{i,t-1} + \alpha^{*LR} \ln S^{*LR}_{i,t-1} + \beta \ln V_{i,t-1} + \beta^* \ln V^*_{i,t-1} + \beta^{*HR} \ln V^{*HR}_{i,t-1} + \beta^{*LR} \ln V^{*LR}_{i,t-1} + \eta_y + \gamma_s + \mu_{i,t}, \quad (3.)$$

where HR refers to a high unemployment ratio and LR to a low unemployment ratio, other variables are the same as previously.

Weak asymmetry for low unemployment ratio is found (Table 2: specification 5). The spill-over effect is significantly different in areas where a “foreign” unemployment is much lower than a local is. In these areas the positive spill-over effect of the vacancies from neighbouring LLOs is weaker than elsewhere. The difference is however rather small.

Interpretations based on dependencies between a local vacancy outflow and foreign vacancy stocks are not unambiguous. According to Burgess’ and Profit’s (2001) results on Britain, an increase in neighbouring vacancy stock decreases the local vacancy outflow but increases local unemployment outflow. The local unemployed workers are matched with neighbouring vacancies, which decreases the local vacancy outflow. In the results of this study, in turn, neighbouring vacancies have positive externality on

local job seekers resulting in positive effect on the local vacancy outflow. An explanation could be that the vacancy outflow itself is spatially autocorrelated. However, the results on the spatial lag model with spatially lagged dependent variable are not statistically significant and thus not reported here.

4.3 Does population density matter?

According to Bunders (2003), open vacancies in Finland are filled most quickly in the eastern and northern part of the country, where LLOs are small, and most slowly in the southern part of the country, where the Finnish population is highly concentrated. There are also much more open vacancies available in the southern Finland. Therefore, an important question is the role of population density in the matching process. According to Coles and Smith (1996) the search process would be faster and matching rates higher in areas with dense pool of workers and firms. According to them, the amounts of job seekers and vacancies do not matter but the population density of the “market place” matters. At a given level of job seekers and vacancies both parties would be close and easy to communicate each other with lower efforts and costs. According to Coles and Smith (1996), higher wages also increase matching rate presumably encouraging greater search effort by the unemployed.

Kano and Ohta (2003), in turn, investigated regional variation in matching efficiencies due to difference in the distribution of heterogeneous labour force and firms. They found that matching efficiency is negatively correlated with population density. Firms have different hiring standards and payable wages because their production technologies are different. Job seekers have different skill levels and different reservation wages. The distribution of hiring standards and skill levels and of payable wages and reservation wages are decisive to the achievement of the matching.

If, for example, firm distribution in an area is concentrated on lower hiring standard and worker distribution is also concentrated on lower skill level, the successful match is relatively easy to form. If, instead, the firms in the area are distributed over the wide range from lower to higher hiring standards and the workers distribution spreads over the wide range from lower to higher skill levels, the successful match is not so easy and

fast to form. Skill requirements and endowments are distributed more widely in urbanised areas with high population density, and therefore population density would lower matching efficiency.

To straighten up the effects of population density in the matching process in Finland, population density (population/km²) is added as an interaction dummy variable into to the model. This dummy variable takes the value 1 if population density in the area is higher than an average value, which is true in 18 LLOs, and 0 otherwise. The population density dummy shows if the level of matching technology is higher or lower in the LLOs with high population density. The coefficients of new interaction variables, in turn, show if the area's own stocks of job seekers and vacancies have stronger or weaker effects on matches in areas with high population density. They also show if the magnitude of spill-over effects is dependent on population density in the local area.

$$\ln M_{i,t} = \mu + \alpha_1 \ln S_{i,t-1} + \alpha_1^* \ln S_{i,t-1}^* + \alpha_2 \text{Pop} \times \ln S_{i,t-1} + \alpha_2^* \text{Pop} \times \ln S_{i,t-1}^* + \beta_1 \ln V_{i,t-1} + \beta_1^* \ln V_{i,t-1}^* + \beta_2 \text{Pop} \times \ln V_{i,t-1} + \beta_2^* \text{Pop} \times \ln V_{i,t-1}^* + \text{Pop} + \eta_y + \gamma_s + \mu_{i,t}, \quad (4.)$$

where POP denotes the population density dummy and * denotes spatial spill-over variables and their coefficients.

In the specification without spatial spill-over variables (Table 3: specification 6), the job seekers' effect on matches in the LLOs with high population density do not differ from the situation of the other LLOs. Vacancies' effect, in turn, differs: the coefficient is notably higher. The positive externality from vacancies to job seekers is so high that the returns to scale are constant. Interestingly, the constant term for the high population density areas is very low. The efficiency of the matching process seems to be much lower in the dense areas than elsewhere. Matching rates at the given pools of job seekers and vacancies are much lower in dense areas than elsewhere. An increase in vacancies, however, increases matches more than elsewhere.

But how is the situation with the spatial spill-overs? The negative effect of neighbouring job seekers on local matches is weaker in the dense areas than elsewhere (Table 3: specification 7). Otherwise, population density does not affect spatial spill-overs. Be-

cause of a strong positive externality from local open vacancies to local job seekers, the constant returns to scale are achieved also in this model specification.

When adding population density in the model, the matching function exhibits constant returns to scale. It seems that population density matters in the matching efficiency, not the size of the pool of vacancies and job seekers. The results clearly indicate that mismatch in the Finnish labour markets increases with population density. The main problem seems to be on the supply side of the labour market. The results support Kano's and Ohta's (2003) view on population density and Bunders' (2003) results on Finland. It seems that firms in dense areas are distributed over the wide range from lower to higher hiring standards, and workers distribution spreads over the wide range from lower to higher skill levels. These heterogeneities cause additional frictions into the labour markets, which lowers matching efficiencies. One additional explanation could be that active labour market programs are more efficiently directed in more rural areas where officials are more familiar with job seekers and employers.

Bunders (2003) argues that in the northern and eastern part of the country the problem in the labour markets is low demand for labour, not mismatch. Open vacancies are filled very quickly, and unemployment is high. On the contrary, in the southern part of the country, the problem in the labour market is mismatch between open vacancies and job seekers. The results of this study support those findings and gives further information of the functioning of regional labour markets in Finland.

5. Conclusions

According to this study, the Finnish local labour markets suffer from a strong congestion effect among job seekers. An open vacancy is filled much easier than a job seeker is employed. Spill-overs from neighbouring areas even strengthen the congestion. When using LLO-specific fixed effects to controlling for unobserved time-invariant differences between the areas, the congestion among job seekers proves to be extremely high. Remarkable signs of asymmetry of the spatial spill-overs are not found.

The results show that the level of the matching efficiency in Finland is much lower in areas with high population density. It is possible that firm distribution in the areas with low population density is concentrated on lower hiring standard and worker distribution is also concentrated on lower skill level. Unemployment in these areas is caused by low demand for labour, not mismatch. Following this conception, the firms in the areas of dense LLOs are, in turn, distributed over the wide range from lower to higher hiring standards and the workers distribution spreads over the wide range from lower to higher skill levels. One additional explanation could be that active labour market programs are more efficiently directed in the areas with lower population density.

According to the results, returns to scale in the matching function are constant when population density is controlled. Otherwise they are diminishing. This indicates that it is density that matters in the matching process in Finland, not the size of the pools of job seekers and open vacancies. Interestingly, the elasticity of a vacancy outflow with respect to a vacancy stock is notably higher in the areas with high population density. Therefore, the difference in matching rates between the two sides of the labour markets is wide in all areas of the country, but it is even wider in the areas with high population density.

Figures and tables

Figure 1. Vacancy outflow and job seeker/open vacancy ratio, 12-month moving averages

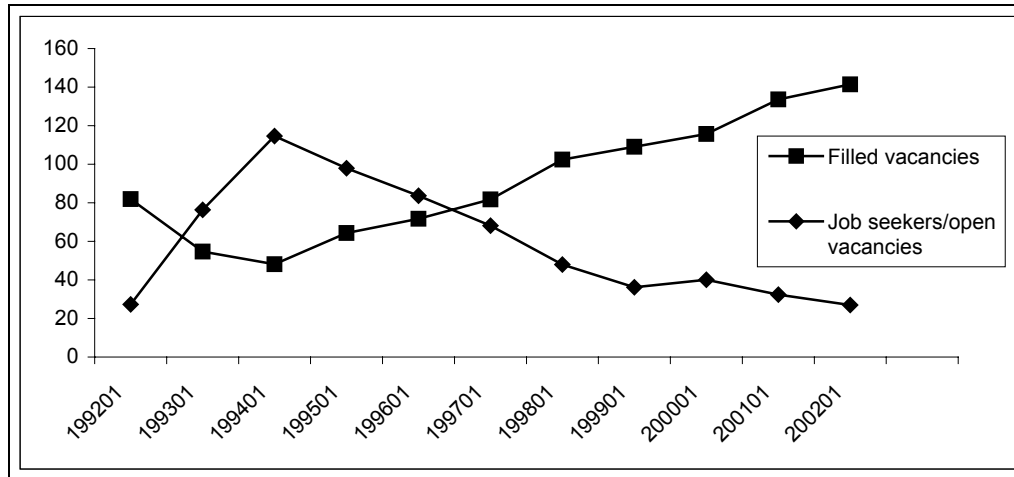


Table 1. Basic descriptive statistics

	All Local Labour Offices			18 LLOs with highest population density		
	Mean	Min/Max	Std.dev.	Mean	Min/Max	Std.dev.
Number of all job seekers	3 455	153/67 206	5 590	10 912	366/67 206	12 900
Number of unemployed job seekers	2 189	48/50 877	3 817	7 218	233/50 877	9 064
Number of open vacancies	74	0/5 115	217	271	0/4 918	498
Number of filled vacancies	95	0/5 116	238	331	0/5 116	599
Population density (population / km²)	57	0.22/3 020	246	419	57/3 020	659
Number of labour	14 176	494/312 606	26 773	52 570	5 093/312 606	65 771
Unemployment rate (%)	17.4	1.1/40.3	6.4	13.8	1.5/28.5	5.5
Job seekers, spatial lag	3 540	271/23 924	2 936	5 550	407/23 715	5 324
Open vacancies, spatial lag	77	0/1 766	121	141	2/1 667	208

Table 2. Summary table for the matching models

Dependent variable: ln (filled vacancies)	Specification				
	(1)	(2)	(3)	(4)	(5)
ln(stock of job seekers) _{t-1}	0.361*** (0.007)	0.069 (0.071)	0.367*** (0.007)	0.243** (0.093)	0.243** (0.092)
ln(stock of vacancies) _{t-1}	0.487*** (0.005)	0.415*** (0.015)	0.485*** (0.005)	0.409*** (0.015)	0.408*** (0.015)
Neighbouring LLO variables					
ln (W x stock of job seekers) _{t-1}			-0.159*** (0.011)	-0.424*** (0.106)	-0.428*** (0.108)
ln (W x stock of vacancies) _{t-1}			0.068*** (0.007)	0.088*** (0.013)	0.1*** (0.015)
Additional spillovers from high unemployment ratio LLOs					
ln (W x stock of job seekers) _{t-1}					-0.015 (0.091)
ln (W x stock of vacancies) _{t-1}					-0.044 (0.036)
Additional spillovers from low unemployment ratio LLOs					
ln (W x stock of job seekers) _{t-1}					0.06 (0.095)
ln (W x stock of vacancies) _{t-1}					-0.057* (0.025)
Constant	-0.736*** (0.045)		0.184* (0.079)		
Returns to scale	0.85***	0.48***	0.76***	0.32***	0.22***
R ²	0.76	0.82	0.76	0.82	0.82
Number of observations	24 047	24 047	24 047	24 047	24 047

Note: All models include year and monthly dummies. Specifications 2, 4, and 5 include LLO specific fixed effects. Panel corrected standard errors are in parentheses. *** denote statistical significance at the 0.1% level, ** at the 1% level, and * at the 5% level. In tests for returns to scale, *** denote deviation from unity at the 0.1% level. W denotes a row-standardised simple binary contiguity matrix. All regressions have also been run leaving the recession period January/91-December/94 away from the analysis, but the results are mainly not significantly different and are not reported here.

Table 3. Summary table for the matching models, population density included

Variables	Specification	
	(6)	(7)
Dependent variable: ln (filled vacancies)		
Population density dummy	-0.878*** (0.087)	-1.342*** (0.146)
ln(stock of job seekers) _{t-1}	0.333*** (0.007)	0.342*** (0.007)
ln(stock of vacancies) _{t-1}	0.474*** (0.005)	0.473*** (0.005)
population density x ln(stock of job seekers) _{t-1}	0.018 (0.013)	0.03 (0.018)
population density x ln(stock of vacancies) _{t-1}	0.178*** (0.010)	0.161*** (0.014)
Neighbouring LLO variables		
ln (W x stock of job seekers) _{t-1}		-0.14*** (0.012)
ln (W x stock of vacancies) _{t-1}		0.062*** (0.008)
population density dummy x ln (W x stock of job seekers) _{t-1}		0.044* (0.022)
population density dummy x ln (W x stock of vacancies) _{t-1}		0.018 (0.016)
Constant	-0.509*** (0.049)	0.286** (0.088)
Returns to scale	0.99	0.94
R ²	0.76	0.76
Number of observations	24 047	24 047

Note: All models include year and monthly dummies. Panel corrected standard errors are in parentheses. *** denote statistical significance at the 0.1% level, ** at the 1% level, and * at the 5% level. In tests for returns to scale, *** denote deviation from unity at the 0.1% level. W denotes a row-standardised simple binary contiguity matrix. All regressions have also been run leaving the recession period January/91-December/94 away from the analysis, but the results are mainly not significantly different and are not reported here.

Endnotes

¹ Local Labour Offices' share of mediated jobs in Finland is quite high. It varied between 1993 and 2002 from 49 per cent to 71 per cent, being lowest in 1993 and highest in 1996 (Hämäläinen 2003). On average, the share is 60 per cent. Law requires public employers to report an open vacancy, whereas for private firms reporting is optional. Despite this, the largest share of open vacancies is in the private sector (Räisänen 2004).

² Unemployment statistics is also compiled by Statistics Finland using a questionnaire. Statistics Finland provides the official unemployment rate in Finland, which is also comparable to that of other EU countries. Regional information in that survey is however available on a more aggregated level than that used here. Moreover, the unemployment register includes much more detailed information on job applicants and filled vacancies.

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